I – Problem Statement Title (04-GS004)

Shortening Closure Pour Waiting Time for Bridge Construction

II – Research Problem Statement

Question: Can time savings be realized in the construction of closure pours for different bridge types, as this then translates to shorter construction periods, cost efficiencies, and reduced traffic exposure?

The waiting time for constructing a widening or joining together new staged construction has been a concern of Bridge Construction Engineers for many years. The current requirement for construction of the closure pour for all bridge types is 60 days after the falsework is released. Some bridge types may not need such a long waiting period. Research is necessary to determine how to shorten the closure pour placement waiting period for bridge construction, thus reducing construction time, minimizing public impact, and reducing exposure of the traveling public to the hazards associated with a construction zone.

III – Objective

The objective of this research is to study the effects and impacts of shortening closure pour placement waiting periods when constructing bridge widenings and staged projects requiring closure pours. Criteria will then be developed to shorten the closure pour placement waiting period based on bridge type and number of spans in the bridge.

Initially, research will focus on the predominant bridge type in the State, cast-in-place post-tensioned (CIP P/S) concrete box girder bridges for both simple span and multi-span bridges. Research may then be expanded to other bridge types assuming there is good correlation between the analytical results and the actual field testing, and it is determined that the closure pour placement waiting period can be reduced. Research will include criteria such as concrete strength and Young's modulus, and will focus on analytical testing to predict dead load deflections from creep and concrete shrinkage. Field monitoring of bridge settlement and stresses at actual construction sites throughout the State requiring closure pours will also be performed to validate the analytical results.

The intent of the research will be to predict the dead load deflections, validate them with field monitoring, and then determine an acceptable waiting period other than 60 days in which to construct the closure pours.

IV – Background

According to Caltrans' "Bridge Memos to Designers" manual, there are two alternative time requirements for falsework release and closure pour placement when a bridge widening is constructed. These two alternatives are added as noted to Caltrans structure plans as follows:

FALSEWORK RELEASE

Alternative 1:

Falsework shall be released as soon as permitted by the specifications. Closure pour shall not be placed sooner than 60 days after the falsework has been released.

Alternative 2:

Falsework shall not be released less than 28 days after the last concrete has been placed. Closure pour shall not be placed sooner than 14 days after the falsework has been released.

When Falsework Release Alternative 2 is used, camber values are 0.75 times those shown.

As far as is known, the statement "Closure pour shall not be placed sooner than 60 days after the falsework has been released" is based mainly on past historical graphs that measure total long term deflection for CIP P/S concrete box girder bridges. These charts are very general in nature and may not be applicable to other bridge types, leading to unnecessary excessive waiting periods. These requirements are also typically applied, perhaps unnecessarily, to new staged construction to tie the different stages of construction together.

V – Statement of Urgency and Benefits

A. Support of the Department's Mission/Goals:

(Improving Mobility: Safety, Reliability, Performance, and Productivity) During the 60-day waiting period between falsework removal and closure pour placement, temporary k-rail is placed adjacent to traffic to protect widening construction from vehicular impacts. K-rail placement often narrows traffic lane width, thus restricting traffic flow during construction. This restriction slows down traffic and poses a safety hazard to vehicular, and often pedestrian traffic. The longer the falsework and k-rail remain in place, the longer the exposure and risk is for the traveling public. Timely completion of the closure pour placement results in removal of the traffic restrictions and enhances the safety of the transportation system.

The traffic restrictions also result in numerous delays to the traveling public. In many parts of the State, construction is seasonal and the potentially extensive waiting period between falsework release and closure pour placement can often extend the contract into another construction season. This results in a reduced travel width until the construction can be completed in the next construction season. A reduction in the closure pour placement waiting period results in a minimized construction impact to the traveling public.

By reducing the waiting period, the Department will be able to more quickly deliver completed construction contracts for reduced costs, thereby improving the efficiency of the transportation system. The savings realized could be used to deliver even more projects.

B. Return on Investment:

By shortening the 60-day closure pour placement period, Caltrans and the Contractor will be able to reduce the number of working days on construction contracts. This results in not only a cost and time savings to the State, but also addresses the pressure by other State and local agencies to open projects more quickly to the traveling public. Reducing the closure pour placement waiting period could have profound impact on reductions to the project cost. Typically, the closure pour is one of the last items of work performed on a construction contract. On many contracts, the remaining work is minimal, resulting in extended overhead for contractors until they can place the closure pour. Time related overhead is a good indicator of the average daily overhead contractors incur. The average TRO on construction contracts over the past 18 months is approximately $2,700 per day. With a reduction of 10 days in the waiting period down to a 50-day waiting period, and assuming approximately 50 closure pours per year, the annual savings could be $1.35M ($2,700/day X 10 days X 50 projects).

VI – Related Research

A search was conducted at TRIS online (http://ntl.bts.gov/tris) and on the TRB "Research in Progress" database (http://rip.trb.org/search). Currently, there is an effort on behalf of the North Carolina Department of Transportation to predict deflections of steel girder structures (Developing a Simplified Method for Predicting Deflection in Steel Plate Girders Under Non-Composite Dead Load for Stage-Constructed Bridges, Contract/Grant Number: NCDOT 2004-14, beginning July 2003 and ending June 2005). This work is geared towards reducing the differential settlement inherent in stage construction of bridges for slightly different, but similar reasons. The research plan should be reviewed as a potential model for the effort requested in this problem statement, but cannot be used to supplant the need identified herein.

VII – Deployment Potential

The results of the analytical study and field measured deflections and stresses would be incorporated into the design manuals and procedures to give bridge engineers guidelines to shorten closure pour placement waiting times. This will have immediate effects as described previously to benefit bridge construction.